

OVERVIEW

Applying leadership and 21st century skills, participants design and build a mechanical device to solve the problem statement for the identified theme. Through device functionality, presentation, and documentation, the team members demonstrate their knowledge of mechanical engineering and the application of their solution. The challenge is to make a vehicle that meets the stated Vehicle Specifications and comes to rest exactly the required distance in the fastest time for the specific conference year. The current year's problem statement will be posted on the [TSA website](#) under *Themes & Problems*.

ELIGIBILITY

One (1) team of two to three (2-3) individuals per chapter may participate.

TIME LIMITS

- A. Pre-built vehicle must be started and completed during the current school year.
- B. The entry must be checked in at the time and place stated in the conference program. At check-in, one team member will sign up for a time slot to return and run the vehicle.

ATTIRE

TSA competition attire is required for submission, the preliminary round, and semifinalist interview.

PROCEDURE

PRE-CONFERENCE

- A. Teams must identify and understand the use of subsystems within a larger system
- B. Teams must research and identify an engineering design process chosen that influenced the design of the vehicle
- C. Participants review and implement the annual problem statement posted on the [TSA website](#) under *Themes & Problems*.

PRELIMINARY ROUND

- A. One (1) team member checks in the entry (see below) at the time and place stated in the conference program:
 - 1. One (1) Mousetrap Car
 - 2. Documentation portfolio including a materials list, a ½ scale technical drawing on letter-sized (8½" x 11") that shows the side and top views of the finished product, and a written description detailing the process
 - 3. The technical drawing title block includes only the student's identification number, which is assigned at conference registration and is placed on the entry and drawing during check-in
- B. Upon check-in, the team member signs up for a performance time slot
- C. Judges evaluate the entries and corresponding components related to the Go/No Go specifications
- D. Participant teams report to the place indicated in the conference program at least five (5) minutes ahead of their time slot. There will be a testing area to prep the vehicle prior to their assigned time.
- E. Once called, participants must have their vehicles ready to run and take the vehicle to the start line
- F. On the "start" command by the conference staff, all vehicles will be set off toward the target line
- G. The timing of the vehicle will begin when any part of the vehicle passes over the start line and will end when the vehicle comes to a complete stop
- H. The distance from the target line will be measured in centimeters, from the point of the vehicle that first passed the start line to the finish line or target. The measurement will be taken after the vehicle comes to a complete stop on its own.
- I. Cars in an assigned time slot will be set on the start line at their assigned time and will run one at a time in a staggered start. The vehicle must steer itself and remain in the lane in which it started. If a car leaves its assigned lane and makes contact with another car, its run is not scored, and the car that was struck by the car that left its lane will be allowed to run again.
- J. Each car has two attempts. The best attempt is recorded.

- K. Each team has a short two (2)-minute exit interview with the judges
- L. The top twenty (20) entries based on the score total that passed the Go/No Go inspection will have their documentation portfolios judged and points combined with performance points and interview points to determine the finalists.

REGULATIONS AND REQUIREMENTS

Students will work to develop their leadership and 21st century skills in the process of preparing for and participating in this TSA competitive event. The development and application of those skills must be evident in their submission, demonstration, and/or communication pertaining to the entry.

PRELIMINARY ROUND

- A. Documentation portfolio is required and must be secured in a [clear front report cover](#) with the following single-sided, 8½" x 11" pages, in this order:
 - 1. Title page with the event title, the conference city and state, the year, and the team/chapter ID number; one (1) page
 - 2. Table of contents; pages as needed
 - 3. Identification and explanation of the engineering design process used to produce the vehicle; maximum six (6) pages
 - 4. Materials list; one (1) page
 - 5. A ½ scale technical drawing on A size paper which includes a top and right-side view of the finished product; one (1) page
 - 6. Written description of the design and construction of the solution which includes photographic verification; pages as needed
- B. Test track
 - 1. The test track consists of lanes created by tape on the conference site floor creating three (3) to five (5) lanes 5' wide. Track surface description (carpet or concrete) will be posted on the [TSA website](#) under *Themes & Problems* under the current year. The length from start to the target line is based on the assigned distance for that year. Three (3) to five (5) vehicles will run simultaneously.

C. Vehicle

- 1. Vehicle must meet the following requirements:
 - a. The overall dimensions of the Mouse Trap Car cannot exceed 20" L x 10" W x 12" H. The measurement is taken while the car is in resting position.
 - b. The vehicle **MUST** be powered by a single VICTOR brand mouse trap measuring 3⅞" L x 1¾" W. The mouse trap spring **CANNOT BE ALTERED** to add power in any way.
 - c. The vehicle must have three (3) or four (4) wheels that make contact with the race surface.
 - d. Vehicles **MUST** be self-starting. The vehicle may not start with additional potential and/or kinetic energy other than what is stored in the mouse trap spring. Rubber bands or any other elastic materials may not be used in the launch mechanism.
 - e. The vehicle must steer itself and may not receive a push in any direction in order to avoid a collision.
 - f. No repair or maintenance is allowed after the entries have been submitted.

EVALUATION

PRELIMINARY ROUND

- A. Each vehicle has two attempts. The best attempt score will be kept.
- B. The scoring will be: the total of the time in seconds added to the distance from the finish line in centimeters when the vehicle comes to a rest and stops. Score=time (seconds) + distance from finish line (cm). The lowest number is the best car.
- C. A car that leaves its lane and strikes another car will not be scored for that attempt.
- D. Any vehicle damaged during the 1st run is evaluated by the event coordinator to determine whether or not the vehicle is allowed to race again.
- E. Each team will have a two (2)-minute exit interview with the judges
- F. Entries placing 1st through 20th will receive points based on that placement as specified in the scoring rubric

SEMIFINAL ROUND

- A. The documentation portfolio of the top 20 teams, based on performance and exit interview scoring, will be judged and points will be added to determine the top 10 finalists.

Refer to the official rating form for more information.

STEM INTEGRATION

This event has connections to the STEM areas of Science, Technology, Engineering, and Mathematics.

LEADERSHIP AND 21ST CENTURY SKILLS DEVELOPMENT

This event provides opportunity for students to build and develop leadership and 21st century skills including but not limited to:

- Communication
- Collaboration/Social Skills
- Initiative
- Problem Solving/Risk Taking
- Critical Thinking
- Perseverance/Grit
- Creativity
- Relationship Building/Teamwork
- Dependability/Integrity
- Flexibility/Adaptability

CAREERS RELATED TO THIS EVENT

This competition has connections to one (1) or more of the careers below:

- Engineer
- Multimedia designer
- Product designer
- Small business owner

MECHANICAL ENGINEERING

2024 & 2025 OFFICIAL RATING FORM

MIDDLE SCHOOL

Judges: Using minimal (1-4 points), adequate (5-8 points), or exemplary (9-10 points) performance levels as a guideline in the rating form, record the scores earned for the event criteria in the column spaces to the right. The X1 or X2 notation in the criteria column is a multiplier factor for determining the points earned. (Example: an "adequate" score of 7 for an X1 criterion = 7 points; an "adequate" score of 7 for an X2 criterion = 14 points.) A score of zero (0) is acceptable if the minimal performance for any criterion is not met.

Go/No Go Specifications

- Before judging the entry, ensure that the items below are present; indicate presence with a check mark in the box.
- If an item is missing, leave the box next to the item blank and place a check mark in the box labeled ENTRY NOT EVALUATED.
- If a check mark is placed in the ENTRY NOT EVALUATED box, the entry is not to be judged.

- ☐ Documentation portfolio is present
- ☐ Vehicle is present
- ☐ Single VICTOR brand mouse trap measuring:
3 $\frac{3}{8}$ " L x 1 $\frac{3}{4}$ " W is the vehicle power source
- ☐ Vehicle dimensions do not exceed 20" L x 10" W x 12" H
- ☐ ENTRY NOT EVALUATED

ENTRY PERFORMANCE

Each team completes two runs. Enter the data of the best run for the team.

Total Run Time (seconds) to Full Stop

Centimeters from target line at Full Stop

TOTAL RUN TIME + CENTIMETERS FROM TARGET LINE AT FULL STOP = ENTRY PERFORMANCE SUBTOTAL

PLACEMENT FROM BEST OF TWO RUNS (60 points)

1st	2nd	3rd	4th	5th & 6th	7th & 8th	9th – 12th	13th – 20th
60 Points	55 Points	50 Points	45 Points	40 Points	35 Points	30 Points	25 Points
PLACEMENT FROM BEST OF TWO RUNS SUBTOTAL (60 points)							

INTERVIEW (20 points)

CRITERIA	Minimal performance	Adequate performance	Exemplary performance
	1-4 points	5-8 points	9-10 points
Team Interview (X2)	Participants show very limited knowledge of (and have difficulty articulating) how the car was produced or decisions made during the production; participants do not exhibit a basic understanding of design elements and functionality, and the rationale is inconsistent or absent. Responses from fewer than all team members.	Participants demonstrate some knowledge of the vehicle production and have adequate knowledge of some processes or reasoning behind the vehicle design. At least some input received from all team members.	All participants show competence and knowledge related to the design and production of the vehicle; participants are able to articulate "reasoning" behind the decisions made. All members of the team contribute.
INTERVIEW SUBTOTAL (20 points)			

Record scores
in the column
spaces below.

Rules violations (a deduction of 20% of the total possible points for the above sections) must be initialed by the judge, coordinator, and manager of the event. Record the deduction in the space to the right.

Indicate the rule violated: _____

PRELIMINARY SUBTOTAL (80 points)

PORTFOLIO CONTENTS (50 points)

CRITERIA	Minimal performance	Adequate performance	Exemplary performance	Record scores in the column spaces below.
	1-4 points	5-8 points	9-10 points	
Portfolio Components (X1)	Portfolio is unorganized and/or is missing three (3) or more components.	Portfolio is missing one (1) or two (2) components and/or is loosely organized.	Portfolio has all required components in order and is well organized.	
Engineering Design Process (X1)	The description of the engineering design process is unclear, unconvincing, and lacks project details.	The description of the engineering design process includes some project details and explanation of steps in the design process.	The description of the engineering design process includes a full explanation of each step in the process; the description is defined, and detailed.	
Mouse Trap Car Drawings (X1)	Only one (1) drawing/sketch of the model is included with little to no labeling.	Two (2) or more drawings/sketches of the model are included and are labeled.	Detailed drawings/sketches of the entire device/model are provided and appropriately labeled.	
Bill of Materials (X1)	A Bill of Materials is included, but more than one (1) material is missing.	A Bill of Materials is included with one (1) material missing; Bill of Materials is generally organized.	A Bill of Materials is included; it includes all components and is organized.	
Written Description of Design/Construction (X1)	The written description is unclear and/or contains distracting errors in punctuation, grammar, and spelling.	The written description is somewhat clear; punctuation, spelling, and grammar are generally correct, with few errors.	The written description is extremely clear; punctuation, spelling, and grammar are correct, with no errors.	
PORTFOLIO CONTENTS SUBTOTAL (50 points)				

Rules violations (a deduction of 20% of the total possible points for the above sections) must be initialed by the judge, coordinator, and manager of the event. Record the deduction in the space to the right.

Indicate the rule violated: _____

SEMIFINAL SUBTOTAL (50 points)

To arrive at the TOTAL score, add any subtotals and subtract rules violation points, as necessary. **TOTAL (130 points)**

Comments:

I certify these results to be true and accurate to the best of my knowledge.

JUDGE

Printed name: _____ Signature: _____



MECHANICAL ENGINEERING

EVENT COORDINATOR INSTRUCTIONS

PERSONNEL

- A. Event coordinator
- B. Judges:
 - 1. Preliminary round, two (2) or more (timed run and exit interview; one (1) one per lane)
 - 2. Semifinal round, portfolio judging, two (2) or more
- C. Assistants
 - 1. One (1) per lane
 - 2. One (1) to manage the prep track area.
 - 3. One (1) to manage a computer where the times and distance from target are recorded in a spreadsheet

MATERIALS

- A. Coordinator's packet, containing:
 - 1. Event guidelines, one (1) copy for the coordinator and for each judge
 - 2. TSA Event Coordinator Report
 - 3. List of judges/assistants
 - 4. Stick-on labels for identifying entries
 - 5. Results envelope with coordinator forms
- B. Display tables for entries
- C. Tables and chairs for event coordinator and judges
- D. Stopwatches, one (1) for each lane
- E. Tape measure (with cm capability), one (1) for each lane
- F. Computer with scoring spreadsheet

RESPONSIBILITIES

AT THE CONFERENCE

- A. Attend the mandatory event coordinator's meeting at the designated time and location.
- B. Report to the CRC room and check the contents of the coordinator's packet.
- C. Review the event guidelines and check to see that enough personnel have been scheduled.

- D. Tape down the test lanes on the floor. Three (3) to five (5) parallel lanes with the start line to finish line measured to the distance for the conference year.
- E. Tape down identical lanes nearby for teams next up on the time slot to make one test run prior to the official runs.
- F. Inspect the area(s) in which the event is being held for appropriate set-up, including room size, chairs, tables, outlets, etc. Notify the event manager of any potential problems.
- G. At least one (1) hour before the event is to begin meet with judges and assistants to review time limits, procedures, regulations, evaluation, and all other details related to the event. If questions arise that cannot be answered, speak to the event manager before the event begins.

CHECK-IN

- A. Check in the entries at the time stated in the conference program.
- B. Check the entry for safety only.
- C. Late entries are considered on a case-by-case basis and only when the lateness is caused by events beyond the participant's control.
- D. In order to compete, participants must be on the entry list or must have approval of the CRC.
- E. Requirements for attire do NOT apply during check-in, only on the first day of the conference.
- F. Secure the entries in the designated area.
- G. Each entry must include the participant's identification number in the upper right-hand corner of the entry.

PRELIMINARY ROUND

- A. Meet with judges to review time limits, procedures, and regulations. If questions arise that cannot be answered, speak to the event manager before the event begins.
- B. Decide on a single exit interview question to be asked of all semifinalists.

- C. Conduct timed runs. Measure and record the distance from the target line and the start to stop time. Give the best run time and distance for each entry to computer record keeper to be entered into the spreadsheet.
- D. Decisions about rules violations must be discussed and verified with the judges, event coordinator, and the CRC manager to determine either:
 - 1. To deduct twenty percent (20%) of the total possible points in this round
 - 2. To disqualify the entryThe event coordinator, judges, and CRC manager must initial either of these actions on the rating form.
- E. After all preliminary runs have concluded, the computer record keeper will sort the list by the total scores column in the event spreadsheet to determine the top twenty (20) entries. Any tie for the last position is broken by the closest distance to the target. If still tied, use time to full stop. Fastest wins the second tie breaker.
- F. Points will be awarded for the best run based on the placement scores. (1st = 60pts, 2nd=55pts, etc.) and entered into the judges' rubric with the exit interview score.
- G. The top twenty (20) entries based on the total of the placement score and the exit interview score is determined.
- H. Manage the pick-up of non-semifinalist entries.

SEMIFINAL ROUND

- A. Judges independently assess the portfolio entries of the twenty (20) semifinalists and enter scores in the respective rubrics
- B. Judges determine the ten (10) finalists and discuss and break any ties.
- C. Submit the finalist results and all related forms in the results envelope to the CRC room.
- D. Manage security and student pick up of all entries at the assigned time and the removal of materials from the area.